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- (73) Proprietor: SONY CORPORATION Tokyo (JP)
- (72) Inventor: Yamaguchi, Akira, clo Bony Energytec Inc. Korlyamia, Fukushima-kun (JP)

- (74) Ripresentative: MÜLLER & HOFFMANN Petentenwälte Innere Wierier Strause 17 \$1607 München (DE)
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- PATENT ABSTRACTS OF JAPAN vol. 012, no. 158 (E-608), 13 May 1888 & JP 02 272471 A (TOSHIBA CORP), 28 November 1957

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# Description

# BACKGROUND OF THE INVENTION

## Fleid of the invention

[UGCT] The present invention relates to a nonequeous-electrolyte secondary battery incorporating a coll electrode formed by laminating elongated positive and negative electrodes through separators such that the outermost layer is the positive electrode.

# Related Background Art

[BRIG] Hitherto, secondary betteries for electronic apparatuses have been nickel-certmium betteries or lead betteries. The progress of the electronic technique made in recent years has estuded the performance of the electronic apparatus to be improved, the size to be radiced and a portable structure to be radiced. As a result, a requirement has erisen to raise the energy density of the escondary bettery for the electronic apparatus. However, there wrises a problem in that the energy density of the nickel-cadmium battery and that of the lead bettery cannot satisfactorily be reised because of low discharge voltages.

[0003] In recent years, a nonaqueous-electrolyte secondary battery has energetically been developed and researched as a secondary battery expected to be expelled of relating the discharge voltage and realizing small cell-discharge and a long filetime against cycle operations. The nonequeous-electrolyte secondary battery has been employed in pitch of the nickel-cadmium battery and the lead battery. The nonequeous-electrolyte secondary battery battery land provides already to electrode made of a material, such as earth as electrode made of a material, such as composite lightments already to be controlled to the composite strict as a composite lightment of the composite strict and a positive electrode made of a composite strict as a composite lightment of the composite strict and a positive electrode made of a composite strict as a composite lightment of the composite strict and a positive electrode made of a composite strict as a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict as a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite strict and a positive electrode made of a composite and a positive electrode made of a composit

[0004] As described above, the nonequeous-electrolyte escondary battery is required to have satisfactory characteristics including a discharge characteristic under a heavy load and lifetime against a cycle operation. Therefore, the abucture of the electrodes of the above-mentioned nonequeous-electrolyte secondary battery has usually been formed into a coil electrode structure as shown in Fig. 1, as shown in Fig. 1, as alongsted positive electrode 103 incorporates positive-electrode-mix layers 102e and 102b formed by applying a positive-electrode mix to each of the two sides of a collector 101. An elongsted negative electrode 106 similarly incorporates negative-electrode-mix layers 105e and 105b formed by applying a negative-electrode inix to each of the two eldes of a collector 104. The positive and negative electrodes 103 and 106 are wound such that a separator 107 is interposed so that a coll electrode 108 is formed. In the foregoing case, internal short circuit occurring when lithium is deposited during a charging operation must be prevented. Therefore, the width and larger of the negative electrode 108 opposite to the positive electrode 108 unably are mede to be larger than those of the positive electrode 108.

[9005] The above-mentioned coil electrode 108 incorporates the negative electrode 108 which forms the innamnost layer and the outermost layer. Therefore, portions, each containing non-reacted negative-electrode active meterial which does not concern the charge/discharge, exist adjacent to the end of the outermost layer of the negative electrode 105 and the innemnost layer of the same. Therefore, the halde portion of the ballary cannot effectively be used. As a result, there exists a problem in that the energy density cannot entitle tools by raised.

[0006] To solve the above-mantioned problems, a technique has been disclosed in Jepanese Patent Laid-Open No. 5-234620. As shown in FIG. 2, an elongated positive electrode 113 incorporates positive-electrode-mix layers 112a and 112b formed by applying a positive-electrode-mix to each of the two sides of a collector 111. An elongated registive electrode-mix to each of the two sides of a collector 114. The positive electrode 113 beformed by applying a negative-electrode-mix to each of the two sides of a collector 114. The positive electrode 113 and the negative electrode 116 are wound anothink a separator 117 is indeposed so that a collector 115 is formed. The outermost layer electrode, with which charge/discharge of the coll electrode 116 is performed, is made to be the positive electrode 113. Moreover, a portion adjacent to an outermost end 113a of the positive electrode and/or a person adjacent to an innarmost end 113b is formed each that the positive-electrode-mix layer 112a (only the inner positive-electrode-mix layer 112a in the foregoing case) is formed on only eithermain surface of the collector 111. Thus, the quantity of the non-rescled regardive-electrode entry on the reduced. Thus, the inside portion of the bettery is effectively used to raise the energy dansity correspondingly.

[0007] However, the above-mentioned cell electrode has the structure as shown in FiG. 2 such that the outermost and 116s of the negative electrode lead 119 is provided for the upper surface of the collector 114 so that a projection is formed on the upper surface. Also the positive electrode 113 has an outermost end 113e formed by only the collector 111. If the projection exists as described above, the projection planess the separator 117 disposed between the negative electrode 116 and the positive electrode 113. Thus, the projection is undestrably brought into context with the collector 111 of the positive electrode 113. It teads to

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a faci that short circuit easily takes place. As a result, a percent defective is retired and, therefore, reliability deteriorates.

# SUMMARY OF THE INVENTION

[0085] In view of the foregoing, an object of the present invention is to provide a nonaqueous-electrolyte secondary bettery which reduce the quantity of a non-reacted solive material for the negative electrode in the battery to effectively use the inside portion of the battery so as to relied the energy density, elongate the lifetime against a cycle operation, prevent a defect and improve the reliability.

[0009] According to one expect of the present invention, there is provided a nonequeous-electrolyte secondary bettery including: a coll electrode formed by laminating on elegand positive electrode which has a positive-electrode collector and an elongated regative-electrode collector and an elegand regative-electrode collector and which has a regative-electrode collector and which has a regative-electrode collector and so that the positive electrode is positive electrode of a regative-electrode collector and by winding a formed laminate such that the positive electrode is positioned at the outermost position of the collector at the position of the positive electrode, wherein the positive-electrode mix layer is formed on only either of mein surfaces of the collector at the positive electrode and/or the positive-electrode mix layer is not formed on the positive-electrode and only the positive-electrode collector is formed, the negative-electrode-risk layer is not formed on the regative-electrode collector at the externost and of the negative-electrode and only the negative-electrode collector is formed, and the outermost end of the negative-electrode allocations from the transported electrode collector positioned at the culturent end of the negative-electrode is, in the direction from the transported electrode collector.

[0010] The nonequeous-electrolyte secondary bettery according to the present invention may have a structure that the coll electrods incorporates a negative-electrods lead adjacent to an outsmost end of the negative-electrods collector positioned at the outsmost end of the negative-electrode, and the negative-electrode lead is positioned more forwards than the outsmost end of the positive-electrode collector positioned at the outsmost end of the positive-electrode.

(9011) The nonequeous-electrolyte secondary battery according to the present invention may have a structure that the soil electrode has a structure that distance it from the outermost and of the negative-electrode beliector positioned at the outermost end of the negative-electrode collector positioned at the outermost end of the positive-electrode collector positioned at the outermost end of the positive-electrode collector positioned at the outermost end of the positive-electrode collector position of the outermost end of the positive collector of the coll electrode satisfies the following relationship on an essuaption that the diameter of the coll electrode is d:

# 0 < L ≤ xd

[0012] The nonaqueous-electrolyte escondary battery eccording to the present invention may have a structure that the negative-electrode mix contains a negative-electrode material and a binder.

[0013] The nonaqueous-elacitolyte secondary bettery according to the present invention may have a structure that the negative-electrode material is at least one type material selected from a group consisting of a crystalline metal colds and an amorphous metal colds which permit deploy/dedoping lithium lone.

(9914) The nonsqueous-electrolyte secondary battery according to the present invention may have a structure that the present invention mit contains a positive-electrods material, a conductive material and a binder.

[0q16] The nonequecus-electrolyte secondary bettery according to the present invention may have a structure that the prestive-electrode material is at least one type material elected from a group consisting of LIMO<sub>2</sub> (where M is at least any one of Co, NI, Mn, Fe, Al, V and TI) and interlayer compounds each containing LL.

[0015] The nonequeous-electrolyte secondary bettery according to the present invarian may have a structure that the separator is made of at least one type material selected from a group consisting of polyathylene and polypropytene. [0017] The nonequeous-electrolyte secondary battery according to the present invention may have a structure that the positive-electrode collector is made of at least one type statutal selected from a group consisting of abuninum, statutes steel and nicital.

[9016] The nonequeous-electrolyte ascendery buttery according to the present invention may have a structure that the negictive-electrods collector is made of at least one type material selected from a group consisting of copper, staintess steel and nicket.

[0019] The nonequeous-electrolyte secundary battery according to the present invention may have a structure that the nonequeous-electrolyte secondary battery contains a nonequeous electrolyte properted by dissolving an electrolyte in nonequeous solvent, and the nonequeous solvent is made of at limit one type meterial selected from a group consisting of propylone carbonate, sthylene carbonate, 1, 2-dimethoxyethans, 1, 2-diothoxyethans, disthyloarbonate,

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y-butyrotectons, tetratrychoturan, 1,3-dioxotens, 4-metryl-1, 3-dioxotens, diethylether, szifotens, methyleuffolens, soetankilo and propionitria.

[0020] The nonequicous-electrolyte secondary bettery seconding to the present invention may have a structure that the stockrolyte is at least one type material selected from a group consisting of LICHO<sub>6</sub>, LIASF<sub>6</sub>, LIPF<sub>6</sub>, LIBF<sub>4</sub>, LIB(C<sub>6</sub>H<sub>2</sub>)<sub>4</sub>. LICI, LER, LISO, CH, and LISO, CF,

[0021] Other objects, features and advertages of the invention will be evident from the following detailed description of the preferred embodiments described in conjunction with the attached drawings.

# BRIEF DESCRIPTION OF THE DRAWINGS

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Fig. 1 is a cross sectional view showing the structure of a conventional nonaqueque-electrolyte ascendery bettery; FIG. 2 is a cross sectional view showing enother conventional nonequenue-electrolyte secondary battery;

FIG. 3 is a cross sectional view showing the structure of a nonaqueous-electrolyte secondary beliefy according to the present invention;

FIG. 4 is a cross sectional view showing the structure of the nonequeous-electrolyte secondary bettery eccording to the present invention:

FIG, 5 is a perspective view showing a portion including a positive-electrode collector of the normaqueous-electrolyte secondary battery according to the present invention.

# DESCRIPTION OF THE PREFERRED EMBODIMENTS

[8023] An embodiment of the present tryention will now be described with reference to the drawings.

[9024] An embodiment of a nonequeous-electrolyte secondary battery according to the present invention is shown In FIG. 2.

[D025] The monequeous-electrolyte secondary bettery examing to this embodiment, as shown in PIG. 3, transporates a positive electrode 3 having positive-electrode-mix layers 2s and 2b formed on the two aldes of a positiveelectrode collector 1. Moreover, a negativa electrode 6 incorporates negative-electrode-mix leyers Sa and So formed on the two sides of the negative-electrode collector 4. The positive electrode 3 and the negative electrode 5 are wound such that a superator 7 is interposed. The separator 7 is a small-pore film made of polypropytene or polyethylene. Thus, a coll electrode is formed. Thus, insulating maratiers 8 are placed on the two vertical surfaces of the coll electrode, followed by accommodating the coll electrode having the insulating members 8 into a battery can 8.

[0925] A battery cover 10 is joined to the battery can 8 by crimping the battery cover 10 through a sealing gester. 11. The battery cover 10 and the battery can 9 are electrically connected to the positive electrode 3 and the negative electrade 6 respectively through a positive-alactrade hand 12 and a negative-electrade lead 13. Thus, the positive electrode and the negative electrode of the buttery are formed,

[0027] Note that a current-limiting thin plate 14 serving as a safety unit is provided for the bettery according to this ambodiment. The positive-electrods lead 12 is welded to the current-limiting thin plate 14 so as to electrically be conrected to the history cover 10 through the current-limiting thin plate 14.

[9025] When the pressure in the battery having the above-mentioned etructure has been raised, the current-limiting thin plate 14 is pushed upwards and therefore deformed. Thus, the positive-electrode lead 12 is cut such that a portion wolded to the current-limiting thin plate 14 is left. As a result, the electric current is limited.

[0829] A cross sectional structure of the nonaqueous electrolyte secondary bettery excepting to the present invention is shown in FIG. 4. In the nonaqueous-electrolyte secondary bullery seconding to this embodiment, the positive-electrods-mix tayer 2a is, as shown in FIG. 4, formed on only either main surface (on the inside) of the positive-electrode collector 1 at a position adjacent to an outsimest and 3s of the positive electrode 3 and/or an innormal and 3b of the same. No positive-electrode-mix layer is formed on the positive-electrode collector 1 of the outermost and 3a of the positive electrods 3. Moreover, no negative-electrods-ruix layer is formed on the negative-electrods collector 4 at an outsimized and the organize electrode 6. That is, only the negative-electrode collector 4 is formed at the outsimost

[9830] In a direction from the inner portion of the coll electrode 15 to the outer portion of the same, an outermost and of the negative-electrode collector 4, which is the outermost and 6s of the negative electrods 6, is positioned more forwards than the outermost end of the positive-electrode collector 1 which is the cutermost end 3a of the positive electrode 3.

[9931] As described above, the positive-electrode-mix layer 2s is formed on only either main surface of the positivee collector 1 at the position edjecent to the outermost and 3s of the positive electrode 3 and/or the position adjacent to the immerment end 35 of the same. Therefore, the necessity of applying the positive-electrode mix to each

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of the two sides of the positive-electrode collector 1 can be eliminated. Therefore, a portion to which the positiveelectrods-mix layer 2s is applied most be formed on the main surface of the positive-electrode collector 1, as shown

[0032] In the nonaqueous-electrolyte secondary battery eccording to the present invention, the negative-electrode teed 13 is formed adjacent to the outermost and of the regultive-electrode collector 4 which is the outermost and 6a of the negative electrode (I of the coil electrode 15. In a direction from the inner portion of the coil electrode 15 to the outer portion, the regative-electrode lead 13 is positioned more forwards than the outermost end of the positive-electrade collector 1 which is the cultermost and 3a of the positive electrode 3. Note that the nonequeous-electrolyte secondary battery eccording to the present invention has a structure that a positive electrode lead (not shown) of the positive electroids 3 is displayed in the inside portion.

[0033] An essemblion will now be described which is made about the following distance of a region in the coll state. trade 15 of the hardeque-dectrolyte secondary beltimy according to the present invention. The distance is a distance in the longitudinial direction from the inner-portion of the coll electrode 16 toward the outer portion of the sense. The exsumption is milde that the distance from the outermost and of the negative-electrode collector 4, which is the outermost and the negative electrode 6, to the outermost and of the positive-electrode collector 1, which is the outermost and 3s of the positive electrode 3, is L. Another assumption is made that the diameter of the coll electrode 15 is d. It is preferable that the relationship  $0 < L \le ad$  is satisfied.

[0034] The nonzqueous-electrolyte secondary ballary according to the present invention incorporates the coll electrode 16. The coil electrode 15 is formed by larginating the alongsted positive electrode 3 and the elongsted negative electrode 6 which rare familiasted through the separator 7 such that the outermost layer is the positive electrode 3. The positive-electrods-mix layer 2s is formed on only either main sturface of the positive-electrods collector 1 at the position adjacent to the outsimetal end Su of the positive electrode 5 end/or this position adjacent to the innermost end Sb. In addition, no positive-electrode mix is formed on the positive-electrode collector 1 at the outermost end 3e of the positive electrode 3. Only the positive-electrode collector 1 is formed at the outermost end 3a. Moreover, no negotive-electrodemix layer is formed on the negative-electrode collector 4 at the automost end 5a of the negative electrode 6. Only the regulive-electrode collector 4 is formed at the outermost end 6a.

[\$635] In the direction from the inner parties of the coll electrode 15 toward the outer parties, the outermost end of the negative-electrode collector 4, which is the outermust end 6e of the negative electrode 6, is positioned more forwards than the cultimost and of the positive-stautrude collector 1 which is the outermost and 3e of the positive electrode 3. Therefore, the quantity of a non-reactive negative-electrode active restarted in the bettery can be reduced. As a result, on effective area can be enlarged correspondingly in the balliary. Thus, the inside portion of the battery can effectively be used, causing the energy density to be related and the lifetime against a cycle operation to be elongated. [0036] The nonequeous-electrifyte secondary battery according to the present invention incorporates the negativeelectrode lead 13 formed adjacent to the outermost end of the negative-electrode collector 4 which is the outermost end 6a of the negative electrode 6. In the direction from the inver portion of the coll electrode 15 toward the outer portion of the same, the negative-electrode lead 13 is positioned more forwards than the outermost end of the positivealectrode collector 1 which is the cutarmost and 3s of the positive electrode 3. Therefore, even if the negative-electrode load 13 plantes the separator 7 disposed between the coil electrode 15 and the battery can 9, the negative-electrode leed 13 is brought into contact with only the battery can 9 which is also the negative electrods. As a result, any internal short direct occurs, no defect takes place and, therefore, the reliability can be improved.

[0037] In the coll electroids 15 of the nonequeous-electrolyte secondary battery according to the present invention, the outermost and of the negative-electrode collector 4, which is the outermost and 6a of the negative electrode 6, and the outermost end of the positive-electrode collector 1, which is the outermost end 3a of the positive electrode 3, are positioned in the turn-end-eff direction from the inner portion of the coll electrode 15 toward the culter portion of the earns. An assumption is much that the distance from the outermost and of the negative-electrode collector 4 to the outsamost end of the positive-electrode collector 1 is L. Another assumption is made that the dismeter of the cult electrode 15 is d. In this case, it is preferable that the relationship 0 < L < xd is satisfied. If the foregoing structure is employed, no internal errori circuit occurs, the energy density is furthermore related and the Biotime against a cycle operation can furthermions by elengated,

[0838] A state will now be considered that the distance L from the outsmost end of the negative-electrode collector 4, which is the outlamnost end the negative electrode 6, to the outermost and of the positive electrode collector 1, which is the outermost and 3e of the positive electrode 3, is shorter than the above-mentioned range, in the foregoing case, the outsimizat end of the positive-electrode collector 1 overlaps the outermost end of the negotive-electrode

[0020] Therefore, this percent defective is raised though the energy density is not lowered, if the distance i, is longer than the above-mantioned range, many portions are produced in which the negative electrode 6 and the positive electrods 3 are not opposite to each other. Therefore; the energy density is undestrably lowered though the perbentage defective to not lowered.

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(8846) The positive electrode 3 and the negative electrode 8 according to the present invention have the abovementioned structures. The mix levers and collectors for constituting the positive electrode 3 and the negative electrode 6 may be known materials.

[9041] The positive-electrode-mix toyers 2s and 2b contain a positive-electrode meterial, which permits lithium lons to be dopeditiedoped, a conductive material and a binder.

[2042] It is preferable that the positive-electrods material contains Li in a sufficiently large quantity. For exemple, it is preferable that to employ a composite metal codile expressed by LIMO, (where M is at least one type of a material selected from a group consisting of Co. NE, Mn., Fe, Al, V and Ti) and composed of LI and a transition matel; or an Interlayer compound containing LL

[0043] The conductive material for importing conductivity to the positive electrode and the binder for causing the positive-electrodo mistorial to be hold by the positive-electrode collector may be known materials.

[DO44] The conductive material may be graphite or carbon black, while the binder may be fluorine realn, such ea polyvinylidene fluoride.

[0045] The negative-electrode-mit; layers Sa and Sb contain the negative-electrode material which permits Ethium lons to be doped/dodoped and a binder.

[2046] The negative-electrode meterial may be a carbon meterial. The carbon material is exemplified by pyrocurbon. coice (plich coice, necesse coice and potroleum coice), graphite, vibreous carbon, a calcinated organic polymer compound (a material obtained by calcinating phenot reisin, furan resin or the Ilio), carbon fiber and active carbon. The negistiveelectrode material may be crystelline metal colde or amorphous metal colde which permits Ethium lons to be depad/ decloped, as well as the foregoing carbon material.

[9047] The binder for causing this negative-electrode material to be hold by the negative-electrode collector may be a known material. For example, the binder may be flucitine restn, such as polyvinysidane suoride.

(19048) The battery according to the present invention contains a known nonaqueous electrolyte in which an electrolyte is dissalved in nonequenue solvent, such as organic solvent.

[0049] The organic solvent is not limited particularly. The organic solvent is examplified by propytone carbonate, strylene carbonate, 1, 2-dimethoxyathana 1, 2-dimethoxyathane, 1, 2-dishoxyathane, distinyi carbonate, y-butyrolectone, tetrohydrofuren, 1,3-diccotane, 4-methyl-1, 3-diccotane, diethylether, suffoliane, methyleufoliane, acetopitrille und propionitrile. Any one of the foregoing material may be employed or a mature of the same may be employed as moved

[0050] The electrolyte is not limited perfection. The electrolyte is examplified by LICIOs, LIAAFs, LIPFs, UBFs, LIB (Carty)4, LICI, LIBr, LISO, CH, and LISO, CF,

[0061] The meterial of the separator 7 is not imited particularly. The meterial is exemplified by woven fabric, unwoven fabrio or small-pore film mede of synthetic resin. In particular, the small-pore film made of synthetic resin is a preferred material. Moreover, a polycialine small-pore tim is a praterned material in viewpoints of resitzing a required thickness, strength of the formed film and resistance of the film, Specifically, the following materials may be employed: a smallpore film made of polyathylene or polypropylene or a small-pore film made of a rabiture of the foregoing materials.

[9052] The shape of the collector of the electrode is not limited particularly. A foil structure, a mesh structure or a net structure made of expand matel may be employed. It is protocoble that the positive-electrode collector 1 is made of, for example, aluminum, stainless steel or rickel. It is proferable that the negative-electrode collector 4 is made of, for

exemple, copper, stainless steel or nickel. [9953] The battery can 8 may be made of fron, nickel, steinless steel or aliuminum. If electrochemical compains occurs In the nemequeous electrolyte containing the above-mentioned material during the operation of the battery, plating may be performed.

# **Examples**

(005-0) Examples of the present invention will now be described with results of experiments.

Manufacturing of Samples>

# Sample 1

[0055] Initially, the negative electrode was maintricitized as follows,

[0086] Petition plich was employed as a starting misterial, followed by calcinating the petroleum pitch so that coarse pitch coits was obtained. The coarse pitch color was pulverized so that powder having an average particle size of 40 jun was externed. Then, the obtained powder was calcinated in an inactive gas at 1000°C to ramove impurities. Thus, calls pareder was obtained.

[0057] Then, 90 parts by weight of trans-obtained color provider, serving as a contex for negative-elactricide active

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material, and 10 parts by weight of polyvinytiderie Reoride (PVDF) serving as a binder were mixed. Thus, a negativeelectrode mix was prepared, followed by dispersing the negative-electrode mix in N-methylpyrolidone which serves as activent. As a result, riegative electrode mix sturry was obtained. The regative-electrode mix sturry was applied to the two sides of a negotive-electrode collector in the form of copper foil having a thickness of 10 µm. Then, the applied solvent was dried. The negative-electrode collector was compression-moduled with a roller preceding mechine, As a result, an elongated negative electrode was obtained which had a width of 41.5 mm and a langth of 250 mm, The thickness of the negative-electrode-mix lever on each side of the negative-electrode collector was 105 pm. The negative-electrode-mix layer was not formed on the negative-electrode collector of the negative electrode at the outermost end. A portion formed by only the negative-electrode collector was created.

[0058] On the offer hand, the positive electrode was manufactured as follows. [9059] That is, 0.05 mole of lithium carbonate and 1 mole of cobalt carbonate were moted with each other, and than the mix was coldinated at 900°C in air for 5 hours. Thus, LICoO $_2$  was obtained.

[0086] Then, obtained LICOO<sub>2</sub> was used as a positive-electrode active material such that 91 parts by weight of LICOO<sub>2</sub>, 6 parts by weight of graphite serving as a conductive material and 3 parts by weight of polyviny/ideno fluorido (PVDF) serving as a binder were mixed with each other. Thus, a positive electrode mix was prepared. Then, the obtained positive-electrode mit was dispersed in N-methylpyrolidone so that positive-electrode mix story was obtained, The positive-electrode mit sturry was applied to a region of only either side of a positive-electrode collector made of elongated eluminum titil having a thickness of 20 µm, the region having a langua of 247 mm. Then, the positive-electrode mix sturry was dried. Then, positive-electrods mix sturry was applied to the other main surface of the positive-electrods collector in a region having a length of 167 mm such that a position at which the application was started was made coincide with the above-mentioned positive-alsorrois talk sturry. Then, the positive-electrode mix sturry was dried, followed by compressing the two sides of the positive-electrode collector with a roll to compression-mold the positiveelectrode collector. Thus, an elongated positive electrode was obtained which had a width of 30.5 mm. The positive electrode incorporated a portion having two aides on each of which the positive-electrode-mix layer was formed, the portion having a length of 187 mm. A portion of the positive electrode, on either side of which the positive-electrodemix layer was formed, had a length of 60 mm. The thickness of each of the positive-electrode-mix layers was 80 µm. The positive electrode had the outstmost end and the innarmost end each incorporating a portion in which the positiveétectrode-mix layer visis not formed and in which only the positive-electrode collector was formed,

[9081] The thre-manufactured elongated positive electrode and the negative electrode and two separators, such of which had a thickness of 25 µm and a width of 44 risn and which were in the form of small-pore polypropytane films, were isminsted. The leminate had four layers formed by sequentially laminating the negative electrode, the separator, the positive alactrods and the separator in this sequential order. The laminate was lengthwise wound plurel times. Those, a spiral shape was formed which had a structure that the portion in which only either side of the positive-electrode collector had the positive-electrods-mix layer was first wound and the negative electrods was placed inside. The end of the Outermost espainter was secured with a tape. Thus, a coll electrode was menufactured. The necessive electrode of the coll electrode was longer than the positive electrode of the same. Therefore, in the direction from the inner portion of the coil electrode toward the outer portion, the outermost end of the negative electrode collector which was the outermost end of the negative electrode was, as a matter of course, positioned more forwards than the outermost end of the positive electroids collector which was the outermost and of the positive electroids.

[0962] The outer dismeter of the coll collector was 13 mm, while the inner dismeter of a hollow parties formed in the central portion of the collector was 3.5 mm. The outenhost end of the negative-electrode collector which was the outsimest and of the negative electrode and the outermost and of the positive-electrode collector which was the outetmost and of the positive electrode were positioned apart from each other in the fore-and-aff direction for distance i. Which Was 35 mm.

[0063] In this embudiment, the negative-electrode lead was positioned at the outermost and of the negative electrode, while the positive-electrode load was positioned at the innermost end of the positive electrode.

[0084] The thus-manufactured coll electrode was accommodated in an iron battery can applied with nickel plating. An insulating plate was placed on each of the upper and lower sides of the coll electrode. The positive-electrode load was connected to the battery cover by welding, while the negative-electrode load was connected to the battery can by

[0065] Then, a nonaqueous electrolyte was prepared by dissolving, at a concentration of 1 mole/liter, LIPFs in a mixed solvent which contained propylene explorate and diethyl carbonate in the earne quantities. Then, 3.0 g of the nonsquence electrolyte was injected into the battery can so se to be impregnated into the coil electrode. Then, the bestery can was crimped strough an insulating sealing gastest applied with supplied so that the bettery cover was secured. Thus, the harmolicity in the buttery was maintained.

[0066] Thus, a cylindrical nonaqueous-electrolyte secondary battery (having a diameter of 14 mm and a height of 50 mm) was manufactured. The foregoing cylindrical normalisous-electrolyte accondary battery was called Semple 1 for convenience,

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# Samples 2, 3, 4 to 6, 11 and 12

[0067] Cylindrical nonequebus-electrolyte accordary batteries were manufactured by a method similar to that for manufacturing Sample 1 except for a structure in which the distance from the outermost end of the negative electrode to the outermost end of the positive electrode which was varied as shown in Table 1. The foregoing secondary batteries were called Samples 4 to 8, 11 and 12. To perform comperisons, cylindrical nonequeous-electrolyte secondary batteries were manufactured by a method similar to that for manufacturing Sample 1. In this case, as shown in Table 1, the cylindrical nonequeous-electrolyte secondary batteries were different from Sample 1 as follows: the distance from the outermost end of the inequitive electrode and the outermost end of the positive electrode was - 2 mm; the positive-electrode collector overlapped the negative-electrode collector in the outermost end of the negative electrode was 0 mm; and the end of the negative-electrode collector and the end of the positive-electrode collector and the end of the negative-electrode collector and the interest portion. The foregoing comparative samples were called Samples 2 and 3 for convenience. Samples 4 to 6, 11, 12, 2 and 3 the positive-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the negative-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the negative-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the negative-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the negative-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the negative-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the negative-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the negative-electrode-mix layers formed on the two eldes of the positive electrode and the lengths of the nega

# Table 1

	Length of Positive-Electrode- Mix Layer Formed on Either Side of Positive Electrode at Innermost End of Positive Electrode (mm)	Length of Positive-Electrode- Mix Layer Formed on Either Side of Positive Electrode at Outermost End of Positive Electrode (mm)	Length of Positive-Electrode -Mix Layers Formed on Two Sides of Positive Electrode (mm)
Sample 1	80	0	167
Sample 2	80	0	167
Sample 3	80	0	167
Sample 4	60	. 0	182
Sample 5	40	o ·	197
Sample 6	20	0_	201
Sample 7	0	5	205
Sample 8	0	15.	202
Sample 9	0	50	175

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Sample 10	40	10	194
Sample 11	60	0	179
Sample 12	60	0	177
Sample 13	60	0	176
Sample 14	395	_	0
Sample 15	. 395	_	0

	Length of Negative-Electrode -Mix Layers Formed on Two Sides of Negative Electrode (mm)	Length of Negative-Electrode -Mix Layers Formed on Either Side of Negative Electrode (mm)	Distance from Outermost End of Negative Electrode to Outermost End of Positive Electrode (mm)
Sample 1	250	0 ,	35
Sample 2	250	0	-2
Sample 3	250	σ	0
Sample 4	245	0	15
Sample 5	240	0	10
Sample 6	224	0	17
Sample 7	213	0	33
Sample 8	220	0	35
Sample 9	229	0	50
Sample 10	247	0	5
Sample 11	243	0	27
Sample 12	241	0	38

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Sample 13	239	0	43
Sample 14	0	398	35
Sample 15	0	398	0

•	Energy Density Ratio (%)	Percent Defective (%)
Sample 1	100.0	3
· Sample Z	100.0	. 20 ·
Sample 3	100.0	18
Sample 4	102.4	3
Sample 5	104.8	1
Sample б	101.9	1 .
Sample 7	100.2	2
Sample 8	101.2	2
Sample 9	97.1	1
Sample 10	105.8	6
Sample 11	. 101.0	1
Sample 12	100.0	2
Sample 13	99.5	3
Sample 14	95.0	2
Sample 15	95.0	20

[9068] Processes striller to that for manufacturing Sample 1 were performed except for structures in which the poselectrode-mix layer was formed on only either side adjacent to the innormost and of the positive electrode, Moreover, the distance from the externment and of the regative electrode to the outermost and of the positive electrode was varied as shown in Table 1. Thus, cylindrical nonequeous-electrolyte secondary butteries were manufactured. The thus-manufactured cylindrical nonequeous-electrolyte secondary batteries were called Samples 7 to 9 for convenience. Samples 7 to 9 were structured such that the outer dismeter of the coll electrode was made to be 13 mm by edjusting the lengths of the positive-electrode-mix layers formed on the two sides of the positive electrode and the langths of the negative-electrode-mix byers formed on the two sides of the negative electrode,

[0086] A cylindrical nonaqueous-electrolyte secondary battery wee manufactured by a method similar to that for

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manufacturing Sample 1 except for structures in which the positive-electrode-mix layer was formed on only either side at positions adjacent to the transmost and outermost ends of the positive electrode. Moreover, the distance from the outsimost end of the negative electrode to the outsimost and of the positive electrode was varied as shown in Table The titue-manufactured cytindrical nonaqueous-electrolyte secondary bettery was called Sample 10 for convenience. Sample 10 was structured such that the culer diameter of the coll electrode was made to be 13 mm by adjusting the langths of the positive-electrode-rulz layers formed on the two sides of the positive electrode.

### Segaple 14 and 18

[0070] Cylinizidal nonaquacus-stactrolyte secondary bederies were manufactured by a method similar to that for manufacturing Sample 1 except for structures in which the positive-electrode-mix layer was formed on the overall length of only either side of the positive electrode and the negative electrode. Moreover, the distance from the outenmost and of the negative electrode to the cularmost and of the positive electrode was varied as shown in Table 1. The thusmanufactured dylinorical nonaqueous-electrolyte secondary betteries were called Samples 14 and 15 for convenience. Sample 14 and 15 were structured such that the outer districtor of the coll electrode was made to be 13 mm by adjusting the lengths of the positive-electrode-mix layers formed on the two sides of the positive electrode.

# <Evaluation of Samples

- [0071] Each of samples 1 to 15 was charged for 8 hours at a charging voltage of 4.20 V with a charging current of 300 mA, and then the foreigning samples were, with a load of 600 mA, discharged to 2.75 V. Thus, the energy densities were measured. Assuming that the result of Sample 3 was 100, the energy doubles of the sample betteries with respect to 100 were oblighted. Also results were shown in Table 1, Moreovar, a percentage defective of each battery was obtained and also results were shown in Table 1,
- 25 > [0072] Competitions were performed by using results shown in Table 1 among Samples 2, 3 and 15 and samples 1, 4 to 14 according to the present invention. Samples 2, 3 and 15 were structured such that the distance from the outamost end of the negative electrode to the outamost end of the positive electrode was - 2 mm. Therefore, the positive-electrode collector overlapped the negetive-electrode collector in the outsernost portion. As an alternative to this, the distance from the cultermost and of the negative electrode to the cultermost and of the positive electrode was O mm. Therefore, the end of the negative-electrode collector and the end of the positive-electrode collector coincided with each other in the outermost portion. Samples 1, 4 to 14 according to the present invention were manufactured such that the outermost end of the negative-electrode collector which was the outermost and of the negative electrode was, in a direction from the inner portion of the coll electrode toward the outer portion of the same; positioned more forwards then the culturmost and of the positive-electrode collector which was the culturmost and of the positive electrods. As a result of the comparisons, the samples according to the present invention enabled the percentage defective to considerably be reduced without reduction in the energy density.
  - [8973] Samples 1 and 4 to 14 according to the present invention were structured such that the outermost end of the nagative-electrode collector which was the outermost end of the nagative electrode was, in a direction from the inner portion of the coll electrode toward the outer portion of the name, positioned more forwards then the outermost end of the positive electrode collector which was the outsimpst end of the positive electrode. Samples 1, 4 to 8 and 10 to 14 among the foregoing samples 1 and 4 to 14 were structured such that the distance L from the outermost and of the hegative-electrode collector which was the outermost end of the negative electrode to the outermost end of the positiveelectrode collector which was the cutarmest end of the positive electrode satisfied  $0 \le L \le nd$  on an assumption that the diameter of the collisischode was d. Sample 9 did not astirfy the above-mentioned relationship. When the foregoing samples were compared with one entities, Sumple 9 encountered susnewhat reduction in the energy density.
  - [0074] Samples 14 and 15, having the electrode mix layer formed on only either side of each of the collectors of both of the positive electrode and the negative electrode, were subjected to a comparison. When the electrode mix tayor was formed on only either side of the collector, Sample 14 according to the present invention enabled the percentage defective to considerably be raduoed without reduction in the energy density. On the other hand, Sample 15 to which the present invention is not applied encountered a high purcentage defective.
  - [0072] As can be understood from the above-mentioned results, the structure of the present invention in which the alongsted positive and negative electrodes were leminated through separature, followed by winding a leminate such that the positive electricis forms the outermost layer so that a coll electrode is formed. Moreover, the positive-electrodemb; layer is formed on only either main surface of the collector of a position adjacent to the outermost and of the positive electroda antifor a position adjacent to the innermost and. At the automost end of the positive electrode; the positiveelectrods-mix layer is not formed on the positive-electrode collector, that is, only the positive-electrode collector is formed. At the outermost and of the negative electrode, the negative-electrode collector is not formed on the negativeelectrode collector, that is, only the negative-electrode collector is termed, in the direction from the immer portion of the

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coil electroide toward the outer portion of the same, the outermost end of the negative-electroide collector, which is the outermost end of the negative electrode, is positioned more forwards than the outermost and of the positive-electrode collector which is the outermost and of the positive electrode: Thus, non-reacted active material for the negative elecgode in the bettery can be reduced. Thus, an affective area can be enlarged in the battery correspondingly. Therefore, the inside portion of the battery can effectively be used, causing the energy density to be releed. Thus, elongation of Eletimo agninat cycle operations was confirmed.

[9076] In the present invention, the negative-electrode lead is formed adjacent to the outermost end of the negativeelectrode collector which is the outermost end of the negative electrods. In the direction from the inner portion of the coil electrode toward the outer parties of the same, the negative-electrode lead is positioned more forwards than the outermost and of the positive-electrode collector which is the curarmost and of the positive electrode. Thus, even if the negative-electrode load plenues the expension disposed between the coll electrode and the battery can, the negativeelectrode lead is brought into contact with only the bettery can which is the same pargetive atoctrode. Therefore, internal short circuit does not take place and, the reform, any defect occurs. Thus, the reliability can be improved.

(2077) In the present invention, the outermost end of the regulive-electrode collector, which is the cutsmost end of its measive electrode, and the outermost and of the positive-electrode collector, which is the outermost and of the positive electrode, one positioned fore-end-aft in the distance from the knner portion of the god electrode toward the outer portion of the same. Assuming that the distince from the outermost end of the negative-electrode collector to the outermost and of the positive-electrody collector is L and the diagneter of the coll electrode is d, the relationship 0 < L  $\leq$  xd is substiced. Thus, the energy density can furthermore be raised and the lifetime against the cycle operation can furthermore be alongwisd.

[0078] The diamater of the cylindrical nonequacus-electralyte secondary battery was varied to 16 mm and 20 mm to evaluate each of the manufactured cylindrical nonequeous-ejectrolyte secondary batteries. Thus, similar tandencies to those shown with the above-monitoried samples were shown.

(2019) An allimitation of electrode was manufactured as the coll electrode so that a nonequecus-electrolyte secondary bettery which was a rectangular battery having a thickness of 9 mm, a width of 34 mm and a height of 48 mm was manufactured so as to be evaluated. The outermost end of the negative-electrode collector which was the outermost and of the negative electrode was positioned more forwards than the outermost end of the positive-electrode collector which was the outenhost and of the positive electrode. The distance from the outenmost and of the negative-electrode collector positioned at the outermost and of the negative electrode to the outermost and of the positive-electrode collector positioned at the outsimost end of the positive electricide which were positioned fore-end-cell was not lunger than the circumference, in this case, reduction of the persentige defective was enabled without reduction in the energy

[0020] As described above, the nonequeous-electrolyte according to the present invention incorporates; a coli electrode formed by laminating an elongated positive electrode and an elongated negative electrode through a separator and by winding a formed leminute such that the positive electrode is positioned at the outermost position, wherein the positive-electrode-mix layer is formed on only either main surface of the collector at the position adjacent to the outermost end of the positive electrode and/or the position adjacent to the insurmost end, the positiveelectrode mix layer is not formed on the positive electrode collector of the outcomest and of the positive electrode and only the positive-electrode collector is formed, the negative-electrode-mixtaver is not formed on the negative-electrode equipolar at the outermost end of the negative electrods and only the regative-electrode collector is formed, and the outermost end of the negative-electrode collector positioned at the cutermost end of the negative electrode is, in the Greation from the inner parties of the coll electrode toward the outer portion of the same, positioned more forwards then the outermost end of the poetitive-electrode collector. Therefore, the non-reacted active meterial for the negative electrode in the battery can be reduced. Thus, the effective battery eras can be enlarged correspondingly. Therefore, the incide portion of the battery can effectively be used, causing the energy density to be raised and the lifetime against a cycle operation to be elongated.

[DOS1] . The nonequeous-electrolyte successary bettery excording to the present invention incorporates the regetivede lead formed adjacent to the outermost end of the negative-electrode collector positioned at the outermost and of the negative electrode and the negative-electrode collector is, in the direction from the inner portion of the coll electrode lowerd the outer portion of the same, positioned more forwards then the outermost and of the positiveelectrode collector. Thus, even if the negative-electrode had pleroes the separator disposed between the cult electrode and the battery can, the negative-electrode toad to brought into contact with only the battery can which is also the regolive electrode. Therefore, informal short circuit can be provenied, any defect can be provented, and the reliability can be improved.

[0982] The coll electrode of the nonaqueous-electrolyte secondary battery according to the present breation is strucbeyon such that the distance L from the outermost and of the negative-electrode collector positioned at the outermost and of the negative electrode to the outermost and of the positive-electrode collector positioned at the autermost and of the positive electrode which are positioned fore-and-aft in the direction from the inner portion of the coll electrode

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inward the outer portion of the same satisfies  $0 \le L \le \pi d$  on an assumption, that the diameter of the coil electrode is d. Thus, internal short circuit can be prevented, the energy density can furthermore be relied and the lifetime against a cycle operation can turtharmore be elongated.

[0083] Although the Invention has been described in its preferred form and structure with a cartain degree of particutarity, it is understood that the present disclosure of the preferred form can be changed in the details of construction and in the combification and arrangement of parts without departing from the acops of the invention de hereinafter cinimed.

### Chalma

A nonequeous-electrolyte eccondary beliefy comprising:

a coil electrode formed by leminating an elongated positive electrode which has a positive-electrode-rolx layer formed on at least either of main surfaces of a positive-electrode collector and an elongated begative electrode which has a negative-electrode-mix layer formed on at least either main serfaces of a negative-electrode collector and by winding a formed luminete such that eald positive electrode is positioned at the outermost position of said coll electrode, wherein

stald positive-electréde-mix layer la formed on only either of main surfaces of said collector at the position adjacent to the othermost end of said positive electrode and/or the position adjacent to the innormost and of said positive electrode, said positive-electrode-mix layer is not formed on said positive-electrode collector et the outermost end of said positive electrode and only said positive-electrode collector is formed,

said negative-electrode-rubt layer is not formed on said negative-electrode collector at the outernost end of eald negative electrode and only said negative electrode collector is formed, and

the outermost end of said negative-electrode collector positioned at the outermost end of said negative electrade is, in the direction from the inner portion of said acid electrode lowerd the outer portion of said coll electrader, positioned more forwards than the outermost end of said positive-electrode collector.

A nonaquiscus-idectrolyte secondary battery scoolsting to claim 1, wherein

said coli electropia incorporates a negative-electrode lazid adjacent to an outermost end of eald negativeelectrode collector positioned at the outermost and of said negative electrode, and said negative-electrode lead is positioned more forwards then the outermost end of said positive-electrode collector positioned of the outermost and of said positive electrode.

3. A nonaqueous-electrolyte secondary battery according to claim 1, wherein seld will electrode has a structure that distance L from the outermost and of said negative-electrode collector positioned at the outsimizations of each negative electrode to the outsimizations and of sold positive-electrode collector positioned at the outermost end of said positive electrods which are positioned in a fore-and-off direction from the inner portion of said coll electrode izward the outer portion of said coll electrode astisfies the following relationship on an assumption that the diameter of the coil electrode is d:

# 0 < L ≤ ±d

- A nonequences-electrolyte secondary bettery according to claim 1, wherein said negative-electrode mix contains a negative-electrode material and a binder.
- A nonequecus-electrolyte secondary bettery according to claim 4, wherein sold negative-electrode material is at least one type material selected from a group constaling of a crystalline metal codde and an amorphous metal codda which parmit doping/dedoping lithium long.
  - A nonaqueous-electrolyte secondary buttery according to claim 1, wherein said positive-electrode mix contains a positive-electrode material, a conductive material and a binder.
  - 7. A nonaqueous-electrolyte secondary bettery according to claim 6, wherein eatd positive-electrode material is at heast one type material selected from a group consisting of LiMO<sub>2</sub> (where M is at least any one of Co, NI, Mn, Fe, AI, V and TI) and interlayer compounds each containing Li.

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- 8. A nonequence-electrolyte secondary battery according to claim 1, wherein eald separator is made of at least one type material splected from a group consisting of polyethylene and polypropylene.
- 9. A nonequeous electrolyte secondary bettery according to claim 1, wherein said positive-electrode collector is made of at least one type material schedule from a group consisting of pluminum, stainless steel and nickel.
- 10. A nonaqueous-electrolyte semandary battery according to claim 1, wherein said negitive-electrods suffector is made of at least one type material selected from a group consisting of copper, steinless steel and nicket.
  - 11. A nonaquédus-electrolyte secondary bettery according to claim 1, wherein
- said nonicqueous-electrolyte secondary buttury contains a nonequenus electrolyte propered by dissolving an 18 electrolyte in nonsqueous solvent, and said nonactions solvers to made of at least one type material salacted from a group consisting of propylone carbonate, ethylene carbonate, 1,2-dimethoxyethane, 1,2-diethoxyethene, diethylcarbonate, p-butyrolectone, tetratrydroftsiam, 1,3-diosolama, 4-methyl-1, 3-diosolana, diethylathar, suffolana, methylauficiana, acatonitrile and propionities.
  - 12. A paraqueous-electrolyte ascendary bettery according to claim 11, wherein estif electrolyte is at least one type material selected from a group constiting of LICIO, LIAST, LIPT, LIPT, LIB(CoH2)4, LICI, LIBr, LISO2CH2 and LISO2CF3

# Patentansprüche

1. Sekundärbetierle mit nicht-villeerigem Elektrolyten, umfeteend:

ninen Elektrodemvickel erheiten durch Leminieren einer längserstreckten positiven Elektrode, bei der staf 21minutesi einer der Haupfflichen eines positiven Elektrodenkollektors eine Sichlicht einer positiven Elektrodenmischung sufgetragen ist, und einer längseretreckten negativen Einktrode, bei der auf zumindest einer der Hauptiffichten einen negetiven Einktrodenkoliektors eine negetive Einktrodenmischung aufgehagen ist, wobel das Leminet in der Weise gewickelt ist, dass die positive Elektrode en der öußeren Seta des Elektrodemwickels Regt, wabei

die Schlicht der positiven Elektrodenswischung nur an einer Stelle, die en des Sußere Ende dar positiven Elektrode engranzt und/oder an einer Stelle, die en des krisse Ende der positiven Bektrode engrenzt, auf eine der Häuptfächen des Kolleidore aufgetregen ist, und auf dem Sulleren Ende der positiven Elektrode die Schicht der positiven Elektrodenmischung nicht auf den positiven Elektrodenkofiektor aufgetragen ist, elso nur der Kölk iktor der positiven Elektrode voidingt,

am Bulleren Ende der negstiven Bektrode die Schicht aus der negstiven Elektrodenmischung nicht auf den Kollektor der negativen Elektrode aufgetragen ist, also nur der Kollektor der negativen Elektrode vorliegt, und vobei in Richtung vom Imaren Absichnitt der gewickelten Eliefdrude zum Sußeren Absichnitt der gewickelten Eliebtrode gesehen das em Sußeren Eride der negativen Elektrode liegende Außere Ende des negativen Elektrodenkeliekters weiter vorne angeordnet ist als des Bulliere Ende des Kollettors der positiven Elektrode.

- der Etektrodenwickeit einen Anschluss für die negative Elektrode aufweist, der an das äußere Ende des am Bußeren Ende der negativan Ekskirude lieganden negativen Elektrodenkollektore enschließt, und der Anschluss der negativen Elektrode weller vorme Eegt als das äkuliers Ende das am Bulleren Ende der poettiven Elektrode liegenden positivan Elektrodenkoliektors.
- 3. Sakundärbetterle mit nicht-wöserigen Elektrolyten nach Anspruch 1, wobei der Elektrodersvickel so gestaltet ist, dass ein Abstand L zelechen dem Sußeren Ende des am Sußeren Ende der regeliven Elektrode angeordneten negeliven Elektrodordolletiere und dem flutteren Ende des em äu-Geren Ende der positivan Bektrode angeordneten poeitiven Elektrodenkollektore, wobei diese in Längerichtung

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von dem innéren Abschnitt des Elektrodenwickels zum Bußeren Abschnitt des Elektrodenwickels hintereinsnder angeordnet sind, die folgende Beziehung erfülz, unter der Armetune, dass der Durchmesser des Elektrodenwickets d entspricht:

# 0 < L ≤ πd.

- Salundärbeitbrie mit nicht-wäserigern Stelthölyten nach Anspruch 1, wobel die negetive Elektrodermischung als Material für die negetive Elektrode und ein Bindermittel umfeset.
- Sekundärbatiete mit nicht-wäserigem Eieldrolyten nach Anspruch 4, wobei
  das Material der negetiven Elektrode zumindest eine Art von Material ist, das ausgewählt ist aus einer Gruppe, walche bestätt aus einem kristellinen Metalloxid und einem amerphen Metalloxid, welche das Dotteren und Dedotteren von Lithkanionen ermöglichen.
- Sekundërbatturia mit nitrit-wiseurigam Elektrohten nach Anspruch 1, wobel die positive Elektrodenmischung ein Material für die positive Elektrode, ein lettfähliges Material und ein Binderskitel umfasst.
- Sakundárbaltarie mit nicht-wässrigem Elaktrolyten nach Anapruch 6, wobei
   daz pozitive Elektroderamaterial zumindaat eine Art von Material armhast, des eusgewählt ist aus einer Gruppe, welche aus LIMO<sub>2</sub> (vröbei M zumindaat eines ist von Co, Ni, Mn, Fe, Al, V und Ti) und Eintegerungsverbindungen bestaht, welche jeweils Li entitelben.
- Sektundärbalferte mit nicht-w\u00e4berigem Elektrolyten nach Amsprüch 1, wobel
   der Separator aus zum\u00e4mdest einem der Materiellen hergestellt ist, welche ausgew\u00e4hill sind aus einer Gruppe, bestehend aus Polyeihyten und Polypropyten.
- Sekundärbeitierte mit rüchf-vröserigem Elektrolyten nach Anternuch 1, webet
  der positive Elektrodenkollektor eue zumindest einem der Materialien hengestellt ist, die ausgewählt sind aus
  einer Gruppe, bestehend aus Akuntrikan, rostligiem Steibl und Mickel.
  - Sekundárbattetie mil nicht-wäserigem Elektrotyten nich Anspruch 1, wobel
    der regetive Elektrodenkollektor aus zumindest einem der Naterialien horgestellt ist, die ausgewählt sind
    eus einer Grüppe, bestehend aus Kupfer, rostfreiem Stahl und Nickel.
  - Sekundikhinflerie mit nicht-wilsstigem Elektrolyten nach Anspruch 1, wobei.

diese einen nicht-wässrigen Elektrohyten enthält, der hergisstellt ist durch Lösen eines Elektrohyten in einem nicht-wässrigen Lösungernätel, und das nicht-salestige Lösungernätel zumindest aus einem der Materialien hergestellt ist, welche ausgewählt sind aus einer Gruppe, bestehend aus Propylandarbonet, Elhylandarbonet, 1,2-Direkthoxyeiten, 1,2-Dieffroxyeiten, Diethylauforen, 7-Butyrolacton, Tetrahydroffren, 1,3-Diomian, 4-Methyl-1,3-dioxolan, Diethylather, Sutistan, Methylaufolan, Acatoritril und Propionari).

48 12. Sokundärbatterte mit nicht-witeerigem Elektrotyten nach Anspruch 11, wobel der Elektrotyt zumindest eines der Materialien ist, die dusgewilhit sind aus einer Gruppe, bestahend aus LICIO<sub>8</sub>, LIAsF<sub>8</sub>, LIPF<sub>4</sub>, LIPF<sub>4</sub>, LIPC<sub>2</sub>H<sub>6</sub>)<sub>4</sub>, LICI, LIPC<sub>4</sub> LISO<sub>3</sub>CH<sub>3</sub> und LISO<sub>3</sub>CF<sub>3</sub>.

# 40 Revendications

1. Acctimitateur secondaire à électrolyte non aqueux compranent :

una électrode en bobine formés en stratiliant une électrode positiva allongée qui prisante une coucha de mélange d'électrode positiva formée sur su moins l'une des surfaces principales d'un collecteur d'électrode positive et une électrode négative allongée qui présente une couche de mélange d'électrode négative formée sur su moins l'une des surfaces principales d'un collecteur d'électrode négative et un enroutant un stratifié formé de toile surfa que ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de la ladite électrode positive est disposée sur la position antérieure de la ladite électrode positive est disposée sur la position antérieure de ladite électrode positive est disposée sur la position antérieure de la ladite électrode positive est disposée sur la position antérieure de la ladite électrode positive est disposée sur la positive est disposée sur la positive est disposée sur la position antérieure de la ladite électrode positive est disposée sur la positive est disposée est la ladite de la ladite électrode positive est disposée est la ladite de la ladite électrode positive est disposée est la ladite de la ladite électrode positive est disposée est la ladite de la ladite de la ladite de la ladite de la ladite est la ladite es

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bobine, dens tequal

Jadite couche de métange d'étactrude positive est formés eur uniquement l'une des surfaces principales dudit collecteur à la position adjacente de l'extrémité extérieure de leulle électrode positive et/ou à la position adjacente de l'extrémité imérièure de ladite électrode positive, fadite couche de métange d'électrode positive n'est pas formés sur lecit collecteur d'électrode positive à l'extrémité extérieure de tedite électrode positive et seul lecit collecteur d'électrode positive et le lecit collecteur d'électrode positive et le lecit collecteur d'électrode positive et le lecit de lecit de

lecite couche de métange d'étectrode régative n'est pas formée sur lecit collecteur d'électrode négative à l'autrémité exidérieure de lecité électrode négative et seul lecit collecteur d'électrode négative et seul lecit collecteur d'électrode négative disposée à l'autrémité extérieure de ladite électrode négative disposée à l'autrémité extérieure de ladite électrode négative se trouve, dans les direction altent de la partie intèrne de ladite électrode en bobline vers le partie externe de ladite électrode en bobline, eleptanée plus en event que l'extérnité extérieure du dit collecteur d'électrode profètée.

2. Accumulateur eccondulm à élactrolyte non aqueux eston la revendication 1, dans lequel

ladite électriste en bobine incurpore un conducteur d'électrode négative edjacent à une extrêmité extérieure dodit collècteur d'électrode négative disposé à l'autrémité extérieure de ladité électrode négative, et ladit conducteur d'électrode négative est disposé plus en avant de l'autrémité extérieure dudit collecteur d'électrode positive disposé à l'autrémité éxtérieure de ladite électrode positive.

3. Accumidateur escondaire à électrolyte non aqueux celon la revendication 1, dans lequel la discurde en bobine présente une structure telle que la distance L. de l'extrémité extérieure dudit collecteur d'électrode inégative disposé à l'extrémité extérieure de ledite électrode négative jusqu'à l'extrémité extérieure de ledite électrode négative jusqu'à l'extrémité extérieure de ledite électrode positive qui sont disposé à l'extrémité extérieure de ledite électrode en bobine vers la partie interne de ledite électrode en bobine vers la partie externe de ledite électrode en bobine satisfait le relation suivante en supposant que le dismittre de l'électrode en bobine est d:

## 0 < L & zd

- Accumulateur accomostre à électrolyte non aqueux seton la revendaction 1, dans lequel ledit métinge d'électrode négative confignt un metérique d'électrode négative et un fient.
- 55. Accumulateire recondaire à électrolyte non eignetic selon la revendication 4, dans lequel leuit matériau d'électrole négative est un matériau d'eu moins un type choisi permi un coyde métallique cristallin et un coyde métallique amorphe qui parinet le dopage/dédopage d'ione ittitum.
- Accumulatour secondaire à électrolyte non aqueux ésten le revendication 1, dans laquel
   todit mélange d'électrode positive confient un matériau d'électrode positive, un malériau conducteur et un
  - 7. Accumulatiour decondaire à éléctrolyte non equeux solon la revéndication 6, dans lequel fedit manieres d'électrode positive est un matérieu d'es moins un type châlei parmi LIMO<sub>2</sub> (où M est l'un quelconque parmi Co, NI, Mn, Fe, AI, V et TI) et des composés de couche intermédiaire contenent chacun LL
  - Accumulatour secondaire à électrolyte non aqueux selon le revendication 1, dans laquel lodit séparateur est constitué d'un matérieu d'au moins un type choisi permi le polyéthylène et le polypropylène.
  - Accumulations secondaire à électrolyte non equeux selon le revendoation 1, dans lequel ledit collector d'électrode positive est constitué d'un matérieu d'eu moins un type choisi parmi l'alumintum, l'actor inoxydable et le nickel.
- 40. Accumulatistir respondaire à électrolyte non aquetor seion la revendication 1, dans leque? legit collecteur d'électrode négative est constitué d'un matériau d'au moins un type cholei parmi le culvre, l'accier inoxydable et le nickel.

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11. Accumulateur secondaire è éléctrolyte non aqueux selon la revendication 1, dans lequel

ledit accumulateur secondaire à électrolyte non aqueux contient un électrolyte non equeux préparé par dissolution d'un électrolyte dans un activent non aqueux, et

lectil solvant non aqueux est constitué d'un matériau d'au moins un type choiai permi le carbonale de propylène, le carbonate d'éthylène, le 1,2-diméthoxyéthene, le 1,2-diéthoxyéthane, le carbonate de diéthyle, la 7-bulyro-lactone, le 16tratydrofurane, le 1,3-dioxolane, le 4-méthyl-1,3-dioxolane, le diéthyléther, le suffoiene, le mélinyleufólane, l'actionitrile et la propionitrile.

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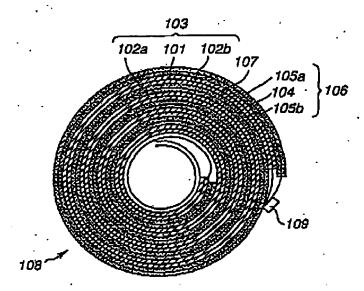


FIG.1

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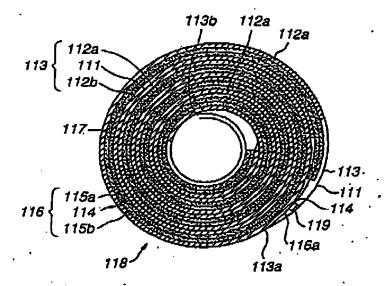


FIG.2

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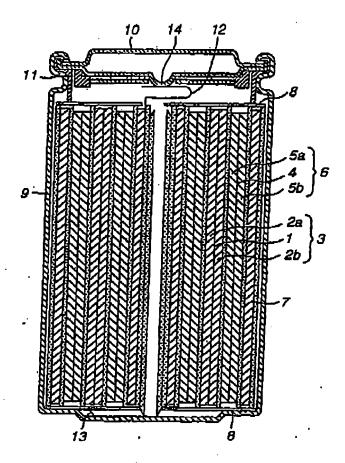


FIG.3

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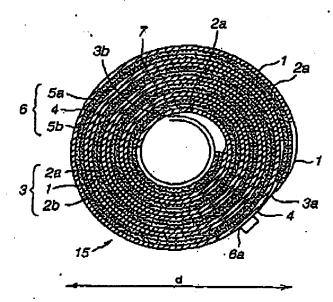


FIG.4

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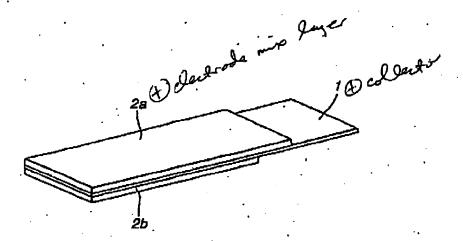


FIG.5